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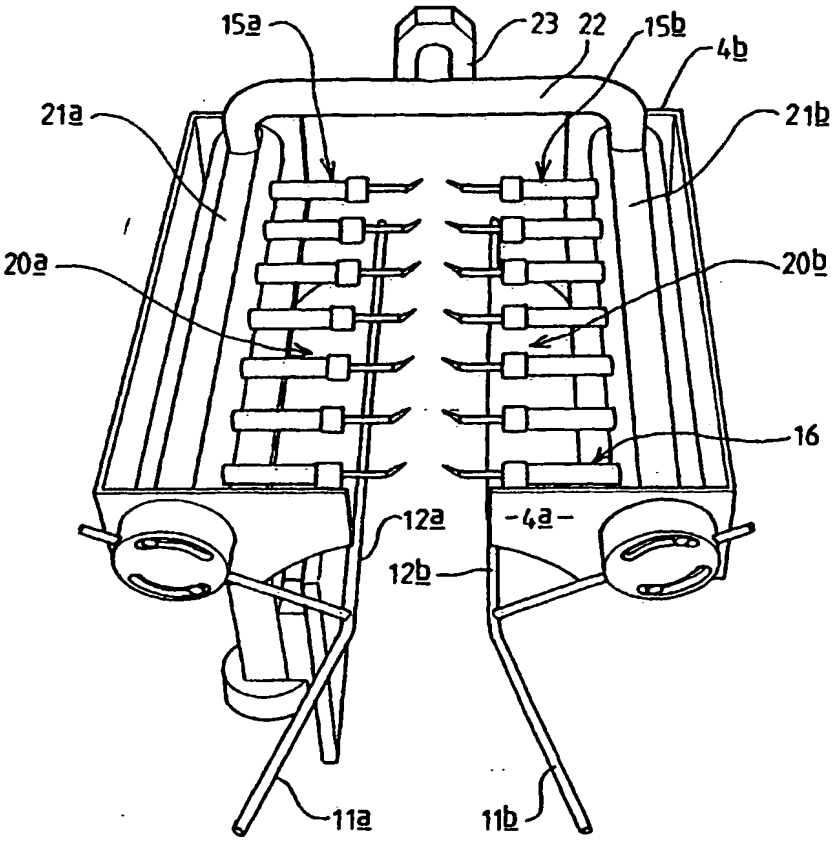

(57) Abstract: A drying apparatus (1) for removing surface moisture from articles travelling on a conveyor, includes a drying enclosure (2) for positioning at a drying portion of the conveyor at least partially to enclose articles travelling along the drying portion of the conveyor. A pair of converging guide rods (11a, 11b) are provided at the entrance (9) to the drying enclosure (2) and are adjustably mounted so that articles arriving at the drying enclosure are engaged and spun as they enter the drying enclosure. Arrays (15a, 15b) of air jets (16) within the drying enclosure directs streams of air from both sides of the conveyor at the articles at selected heights above the conveyor to displace moisture from the surface of the articles. The enclosure has drainage sumps (20a, 20b) at the base thereof and air extraction hoods (21a, 21b) above the air jet arrays for collecting and discharging the displaced water from the enclosure.

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Declaration under Rule 4.17:

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DESCRIPTION OF INVENTION:

"Drying Apparatus for Articles on a Conveyor'

THIS INVENTION relates to improvements in or relating to the drying of the exterior surfaces of articles as they are transported on a conveyor. The invention is particularly but not exclusively applicable to the drying of containers travelling on a conveyor.

A processing plant for filling containers such as cans, jars and bottles typically includes a production line on which the containers are filled, washed and dried prior to undergoing some further process, such as the addition of labels or bar codes, which requires a substantially dry surface.

Known drying stages for such production lines employ stationary air jet means for directing a jet or jets of air onto the containers travelling on a conveyor in order to dislodge residual moisture from the outer surface. These known drying stages frequently fail to remove the moisture from all of the external parts of the container, and in particular fail to remove moisture from leading and trailing surface portions of the containers on the conveyor.

It is an object of the present invention to provide an apparatus which enables residual surface moisture to be efficiently removed from the whole of the exterior surface of articles travelling on a conveyor.

Accordingly, the present invention provides a drying apparatus for removing surface moisture from articles travelling on a conveyor, including: a drying enclosure for positioning at a drying portion of the conveyor at least partially to

enclose articles travelling along the drying portion of the conveyor; means for imparting a spinning motion to the articles as they pass through the drying enclosure; an array of air jets for directing streams of air at selected heights above the conveyor at the articles as they pass through the enclosure to displace moisture from the surface of each article into the air; and means for withdrawing moisture-containing air from the enclosure.

In one embodiment of the invention, the means for spinning the articles comprises a pair of spaced apart guide rods, one of which is positioned to be contacted by a side surface of an article travelling on the conveyor to impart a turning moment to the article.

Preferably, at least one of the guide rods is adjustably mounted so that the relative positions of the guide rods can be varied.

In an embodiment of the invention, the guide rods are both adjustably mounted so that the relative positions of the guide rods and their height above the conveyor are variable.

Conveniently, the guide rods are attached to respective transversely extending mounting arms which are independently adjustable about respective axes parallel to the direction of travel through the apparatus to enable the relative positions of the guide rods to be adjusted.

Advantageously, the or each guide rod is carried by a respective turret which is rotatably mounted on the drying enclosure.

Preferably, the guide rods comprise respective inlet portions which converge in the direction of conveyance, so that the inlet portions form a funnel-like entry

guide to the drying enclosure, the relative position of the guide rods being adjustable so that the articles contact one of the inlet portions and are spun on the conveyor as they enter the drying enclosure.

In another embodiment, the means for engaging and spinning the articles comprises a stationary strip covering part of the width of the conveyor at the drying enclosure and so arranged that part of a base of an article travelling on the conveyor contacts the stationary strip and is therefore subjected to a turning moment which spins the article.

In a further embodiment, the means for spinning the articles comprises a portion of the conveyor which is longitudinally divided to form two adjacent tracks travelling at different speeds, so that a base of an article travelling on the conveyor is subjected to a turning moment which spins the article.

In yet another embodiment, the means for spinning the articles comprises a curved portion of the conveyor and a guide rail arranged to be contacted by a side wall of the article as the article travels around the curved portion of the conveyor, so that the article is spun by the resulting turning moment exerted on the article by the guide rail.

Desirably, the air jets comprise nozzles having an outlet orifice with a diameter of about 0.75mm, the nozzles being fed with compressed air at a pressure of between 1.5 and 4 bar.

Preferably, the enclosure has a base forming a sump for collecting water droplets dislodged from the articles by the air jets and draining downwardly in the enclosure, and means for draining water from the sump.

Advantageously, the enclosure has a hood to collect air containing water droplets dislodged from the articles by the air jets and suction means connected to the hood to extract the water laden air from the enclosure.

The apparatus may include sensing adapted to be disposed at an upstream location relative to the drying enclosure, which sensing means is operative to detect the absence of articles on the conveyor and to close a control valve to interrupt the supply of air to the air jets after a predetermined delay.

Preferably, the sensing means is operative to open the control valve again to re-start the supply of air to the air jets upon detecting the arrival of an article at the upstream location.

Desirably, the sensing arrangement includes a sensor to monitor the pressure of compressed air supplied to the air jet arrays and operative to shut off the supply of air if the pressure falls below 1.5 bar.

In order that the invention may be more readily understood, embodiments thereof will now be described, by way of example, with reference to the accompanying drawings, in which:

FIGURE 1 is a schematic upstream end view of one embodiment of a drying apparatus according to the present invention for installation on the conveyor of a processing plant for filling containers, such as bottles, which apparatus employs one form of arrangement for spinning the containers as they pass through the apparatus;

FIGURE 2 is a schematic perspective view of the apparatus of Figure 1 as seen from the upstream end and above and with a cover of an enclosure of the apparatus removed;

FIGURE 3 is a schematic perspective view of the Figure apparatus as seen from the upstream end, one side and above, the cover of the enclosure again being removed;

FIGURE 4 schematically illustrates another form of arrangement for spinning the containers as they pass through the drying apparatus;

FIGURE 5 schematically illustrates a further form of arrangement for spinning the containers as they pass through the drying apparatus; and

FIGURE 6 schematically illustrates yet another form of arrangement for spinning the containers as they pass through the drying apparatus.

Referring initially to Figure 1, a drying apparatus 1 embodying the invention is shown. The apparatus 1 is suitable for drying articles, such as containers, and may, by way of example, be installed on a production line in a bottling plant to dry filled and closed bottles travelling on a conveyor (not shown) towards a labelling station (not shown) at which the bottles are provided with labels.

The bottles arriving at the drying apparatus 1 have been filled, closed and washed. The bottles carry residual moisture on much of their surfaces. Such residual moisture prevents the proper application of labels and can result in unacceptably wet bottles being packaged.

The structure of the conveyor on which the bottles are transported is typical of that found in the bottle and can processing industry, and comprises stands supporting a stringer at spaced apart locations above a floor. A conveyor belt is mounted on the stringer the bottles travelling on the belt between two horizontally spaced guides each formed by a pair of vertically spaced guide rails.

As shown in Figures 1 to 3, the drying apparatus 1 comprises a tunnel-like enclosure 2 having an open bottom, which enclosure 2 is positioned above a drying portion of the conveyor belt, so that a top 3 and vertical end and side walls 4a, 4b and 5a, 5b of the enclosure 2 enclose a length of the conveyor belt. The apparatus 1 is provided as a bolt-on accessory which may be mounted on an existing production line by attaching a mounting plate 6 of the apparatus 1 to a support at the desired location on the production line. A telescopic mounting arm 7 attached to the mounting plate 6 carries the enclosure 2 of the apparatus 1 at a free end thereof and allows the vertical position of the enclosure to be adjusted relative to the mounting plate 6, thereby enabling the apparatus to be adapted to a particular production line.

An entry guide 8 is provided at the upstream end of the enclosure 2 to engage and impart a spinning motion to the bottles as they approach the entrance portal 9 of the enclosure 2. The entry guide 8 is in the form of a pair of guide rods 10a and 10b having respective entry guide portions 11a and 11b which converge in the direction of conveyance and respective through guide portions 12a and 12b which both extend parallel to the direction of conveyance. The guide rods 10a and 10b are fixed to respective mounting arms 13a 13b which are themselves carried by respective mounting turrets 14a and 14b rotatably secured to the upstream end wall 4a of the enclosure 2.

As seen in Figures 2 and 3, two confronting linear arrays 15a and 15b of air jets 16 are arranged within the enclosure 2 along respective longitudinal sides of the enclosure 2. The air jets of each array 15a or 15b are connected via a respective common air inlet manifold (not shown) to a supply of compressed air at a pressure of 1.5 to 4 bar.

Each air jet comprises a barrel 17, a flexible nozzle 18 provided with a tip 19 having an outlet orifice with a diameter of 0.75 mm.

A base of the enclosure 2 forms respective trough-like sumps 20a, 20b beneath the air jet arrays 15a, 15b and respective extraction hoods 21a, 21b extend within the enclosure 2 along the side walls 5a, 5b above the air jet arrays. The extraction hoods 21a, 21b are connected by ducting 22 to a source of suction, such as a Coanda effect air moving device 23.

The apparatus 1 may include a sensing arrangement (not shown) including a detector device for installation at a desired location on the conveyor upstream of the enclosure 2 to detect the passage of bottles past the upstream location, the sensing device being connected to a shut-off valve controlling the supply of compressed air to the air jet arrays 15a, 15b and operative to block the supply of air to the air jets 16 when no bottles pass the upstream location and to restart the supply of air to the jets 16 when bottles again start to flow past the upstream location. It can thus be ensured that compressed air is only consumed by the drying apparatus when it is actually drying bottles. The sensing arrangement may also include a sensor which monitors the pressure of the compressed air supplied to the air jet arrays and is operative to shut off the supply of air if the pressure falls below 1.5 bar.

Having installed the apparatus embodying the invention at a desired location on a production line and adjusted the position of the enclosure 2 relative to the mounting plate 6, the turrets 14a, 14b are rotated to position the guide rods 10a, 10b at a height above the conveyor which is appropriate for the particular bottles to be dried. One of the guide rods 10b is, however, positioned slightly nearer to the centreline of the conveyor than the other guide rod 10a, so that the one guide rod 10b is contacted by each bottle as it enters the tapered entry guide 8 formed by the entry portions 11a and 11b of the guide rods 10a, 10b and the bottle is slightly tilted and spun about its vertical axis as it rolls along the guide rod 10b. The spinning motion thus imparted to each bottle continues as the bottle passes through the enclosure 2, so that the whole of the circumference of the bottle is presented to the air jet arrays 15a, 15b as the bottle progresses through the enclosure 2.

Before starting operation, the flexible nozzles 18 of the air jets 16 may also be individually adjusted so that the jets of air emerge from the nozzle tips 19 at different heights and in different directions, so as to direct air at all of the potentially wet areas of a bottle.

As the conveyor transports bottles to be dried through the enclosure 2, air is supplied to the air jet arrays 14a, 14b from the compressed air source and is directed onto the bottles by the nozzles 18. The moisture is dislodged from the bottles by the high velocity jets of air emerging from the tips 19 of the air jets 16 and forms a mist or suspension of small water droplets in the air contained in the enclosure 2. This water laden air is continuously withdrawn through the exhaust ducting from the space below the hoods 21a, 21b and above the air jet arrays 14a, 14b by the suction device 22 and passes into a known moisture separation system, thereby removing the moisture from the immediate

environment of the conveyor 3. Any moisture which may be deposited on the surfaces of the enclosure below the air jets drains into the sumps 20a, 20b at the base of the enclosure (2) and is removed from the enclosure through drain holes connected to drainage pipes (not shown) leading to a collection chamber.

The sensing means upstream of the drying enclosure 2 detects any gap or interruption in the stream of bottles on the conveyor and, after a predetermined delay, operates to close the control valve in the air line supplying the air jets 16, thereby economising on the use of air when no bottles are passing through the enclosure 2. Once the sensing means detects that bottles are again arriving at the upstream location, it opens the control valve to re-start the air supply to the air jets 16.

Figures 4 to 6 show examples of other forms of arrangement which may be used to spin the containers travelling through the drying enclosure of a drying apparatus embodying the invention instead of the guide rods employed in the embodiment of Figures 1 to 3.

In the arrangement illustrated in Figure 4, a strip-like stationary shield 40 covers a portion of the width of a conveyor track 41 at the drying apparatus. As a container 42 approaches the drying enclosure, a base of the container runs onto the shield 41, so that part of the base rests on the upper surface of the shield 40 and part of the base rests on the conveyor track.41 as the container is conveyed through the drying enclosure. The turning moment exerted as the container is driven along the surface of the stationary shield 40 by the moving conveyor track 41 causes the container to spin about its vertical axis in the direction indicated by arrow 43.

The arrangement shown in Figure 5 employs a conveyor having a track 50 which is divided longitudinally into two adjacent portions 51 and 52 at the drying apparatus. Portion 51 of the conveyor track is driven at a lower speed than track portion 52, so that the base of a container 53 resting on both portions of the conveyor track 50 is subjected to a turning moment in the direction of arrow 54.

Figure 6 shows an arrangement for spinning containers 60 in which the conveyor comprises a curved portion of track 61 at the drying apparatus and a curved guide rail 62 mounted above the track. A side surface of the container 60 runs against the guide rail 62 as the container is conveyed around the curved track portion 61 and the container 60 is thereby caused to spin as it is conveyed along the guide rail 62 by the conveyor.

In the present specification "comprise" means "includes or consists of" and "comprising" means "including or consisting of".

The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

CLAIMS

1. A drying apparatus for removing surface moisture from articles travelling on a conveyor, including: a drying enclosure for positioning at a drying portion of the conveyor at least partially to enclose articles travelling along the drying portion of the conveyor; means for imparting a spinning motion to the articles as they pass through the drying enclosure; an array of air jets for directing streams of air at selected heights above the conveyor at the articles as they pass through the enclosure to displace moisture from the surface of each article into the air; and means for withdrawing moisture-containing air from the enclosure.

2. A drying apparatus according to Claim 1, in which the means for spinning the articles comprises a pair of spaced apart guide rods, one of which is positioned to be contacted by a side surface of an article travelling on the conveyor to impart a turning moment to the article.

3. A drying apparatus according to Claim 2, in which at least one of the guide rods is adjustably mounted so that the relative positions of the guide rods can be varied.

4. A drying apparatus according to Claim 3, in which the guide rods are both adjustably mounted so that the relative positions of the guide rods and their height above the conveyor are variable.

5. A drying apparatus according to Claim 4, in which the guide rods are attached to respective transversely extending mounting arms which are independently adjustable about respective axes parallel to the direction of travel

through the apparatus to enable the relative positions of the guide rods to be adjusted.

6. A drying apparatus according to any one of Claims 2 to 5, in which the or each guide rod is carried by a respective turret which is rotatably mounted on the drying enclosure.

7. A drying apparatus according to any one of Claims 2 to 6, in which the guide rods comprise respective inlet portions which converge in the direction of conveyance, so that the inlet portions form a funnel-like entry guide to the drying enclosure, the relative position of the guide rods being adjustable so that the articles contact one of the inlet portions and are spun on the conveyor as they enter the drying enclosure.

8. A drying apparatus according to Claim 1, in which the means for engaging and spinning the articles comprises a stationary strip covering part of the width of the conveyor at the drying enclosure and so arranged that part of a base of an article travelling on the conveyor contacts the stationary strip and is therefore subjected to a turning moment which spins the article.

9. A drying apparatus according to Claim 1, in which the means for spinning the articles comprises a portion of the conveyor which is longitudinally divided to form two adjacent tracks travelling at different speeds, so that a base of an article travelling on the conveyor is subjected to a turning moment which spins the article.

10. A drying apparatus according to Claim 1, in which the means for spinning the articles comprises a curved portion of the conveyor and a guide rail arranged to be contacted by a side wall of the article as the article travels

around the curved portion of the conveyor, so that the article is spun by the resulting turning moment exerted on the article by the guide rail.

11. A drying apparatus according to any preceding Claim, in which the air jets comprise nozzles having an outlet orifice with a diameter of about 0.75mm, the nozzles being fed with compressed air at a pressure of between 1.5 and 4 bar.

12. A drying apparatus according to any preceding Claim, in which the enclosure has a base forming a sump for collecting water droplets dislodged from the articles by the air jets and draining downwardly in the enclosure, and means for draining water from the sump.

13. A drying apparatus according to any preceding Claim, in which the enclosure has a hood to collect air containing water droplets dislodged from the articles by the air jets and suction means connected to the hood to extract the water laden air from the enclosure.

14. A drying apparatus according to any preceding Claim, including a sensing arrangement including a detector adapted to be disposed at an upstream location relative to the drying enclosure, which detector is operative to detect the absence of articles on the conveyor and to close a control valve to interrupt the supply of air to the air jets after a predetermined delay.

15. A drying apparatus according to Claim 14, in which the detector is operative to open the control valve again to re-start the supply of air to the air jets upon detecting the arrival of an article at the upstream location.

16. A drying apparatus according to Claim 14 or 15, in which the sensing arrangement includes a sensor to monitor the pressure of compressed air supplied to the air jet arrays and operative to shut off the supply of air if the pressure falls below 1.5 bar.

17. A drying apparatus substantially as hereinbefore described with reference to the accompanying drawings.

18. Any novel feature or combination of features disclosed herein.

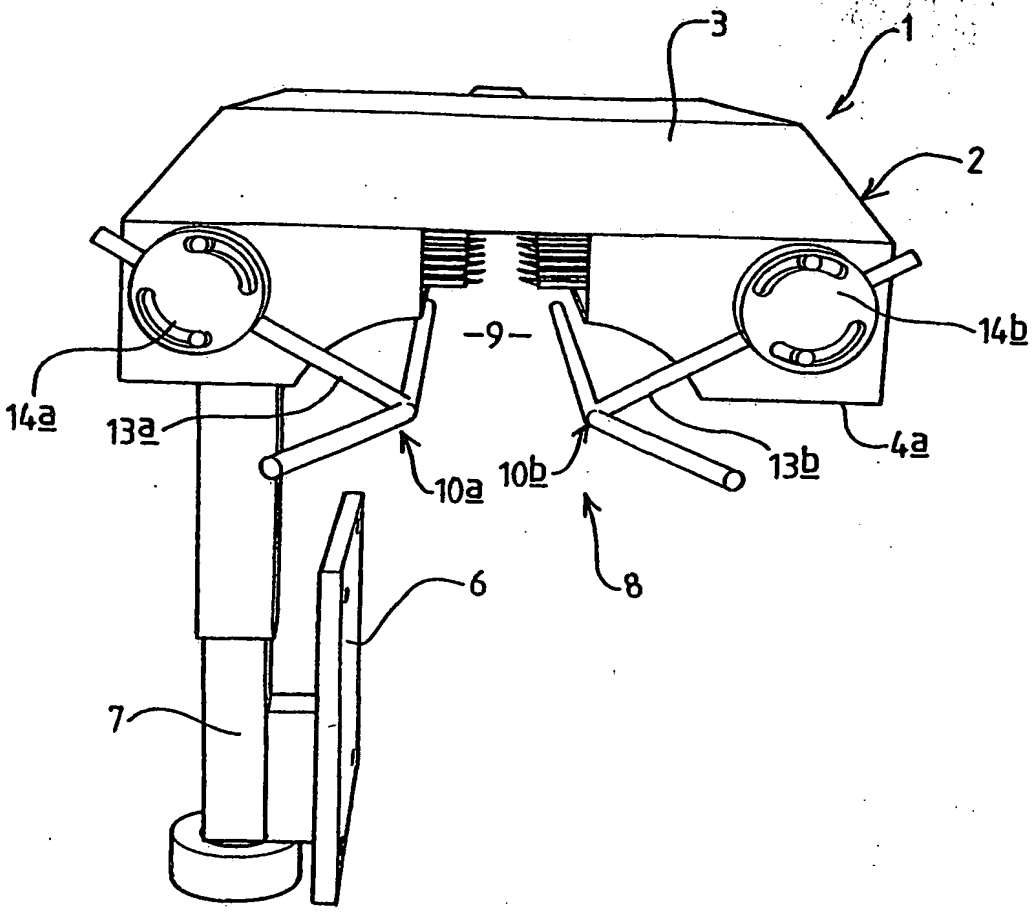

FIG 1

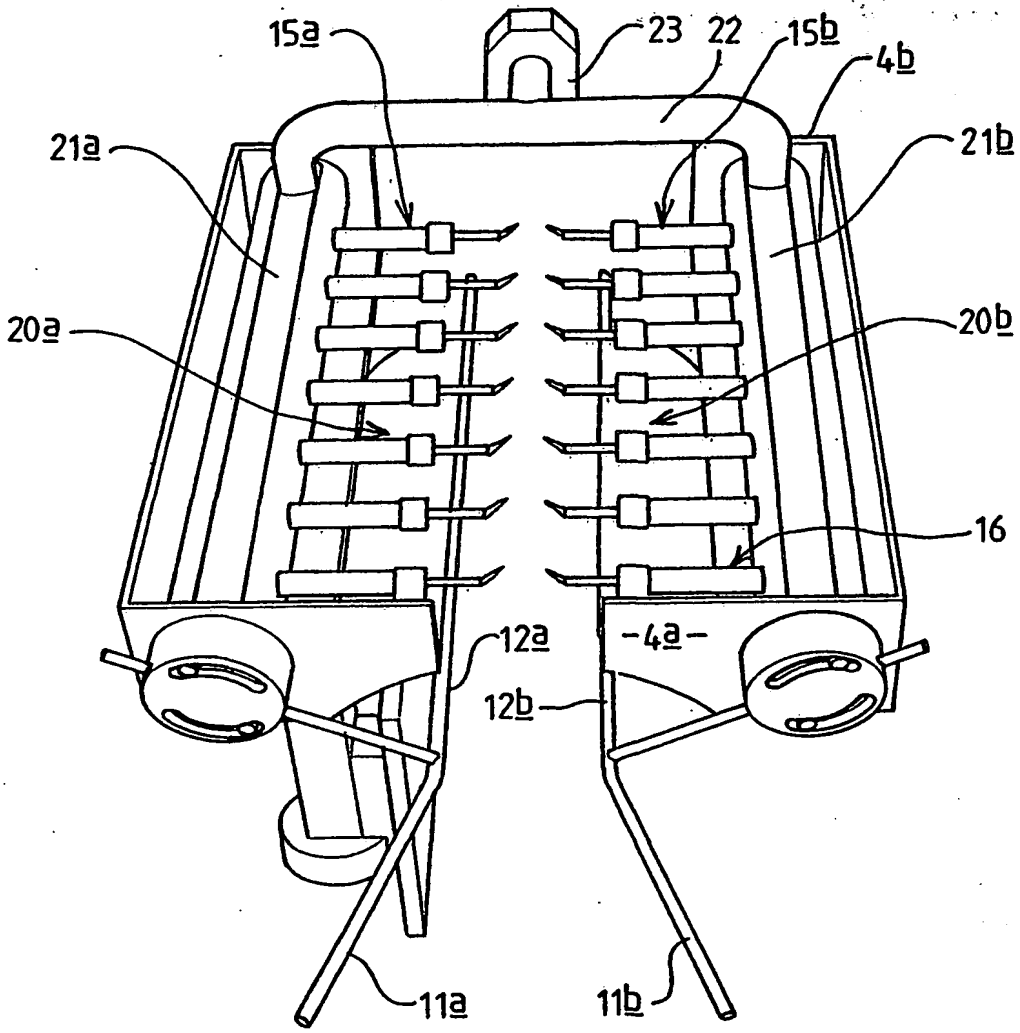

FIG 2

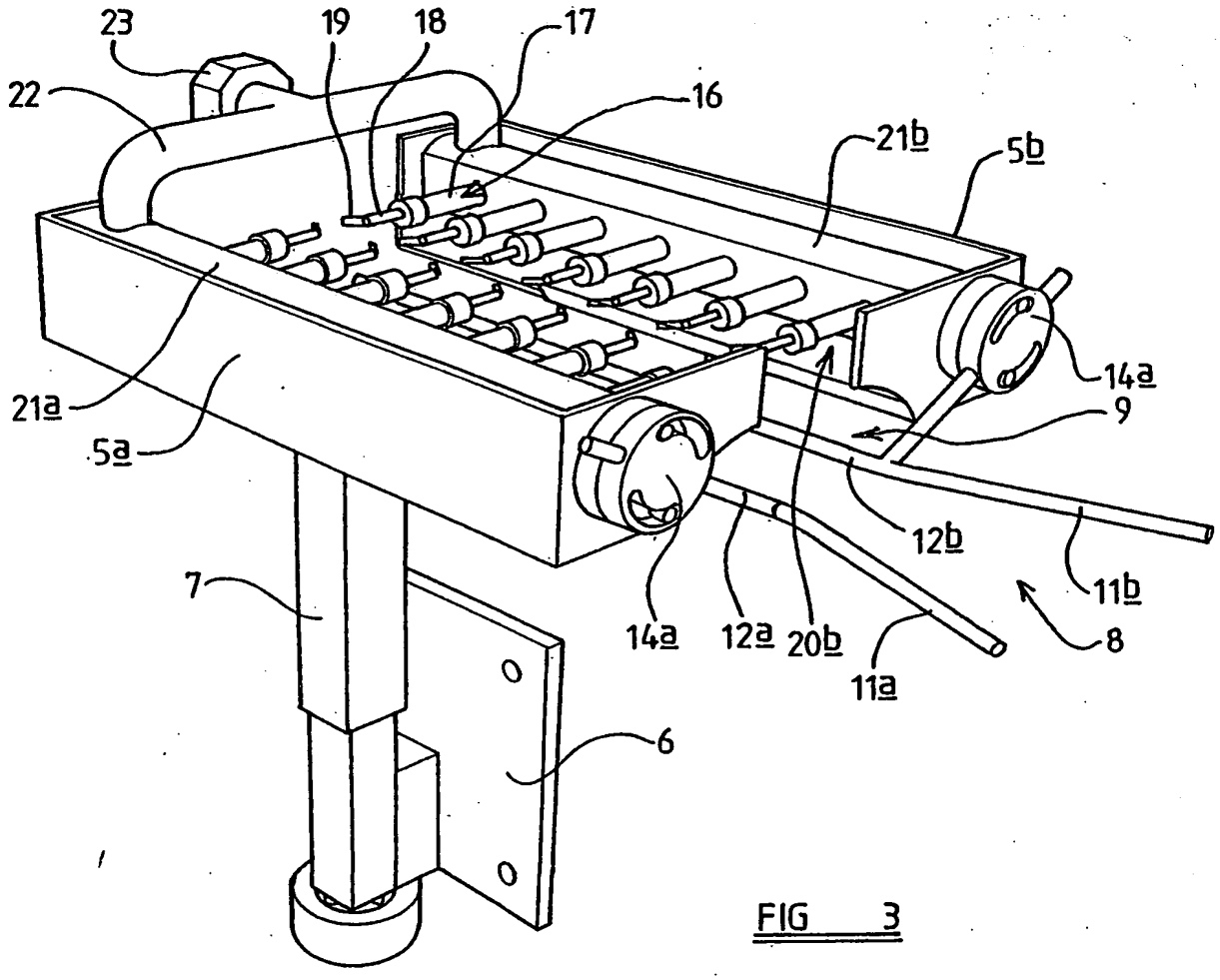

FIG 3

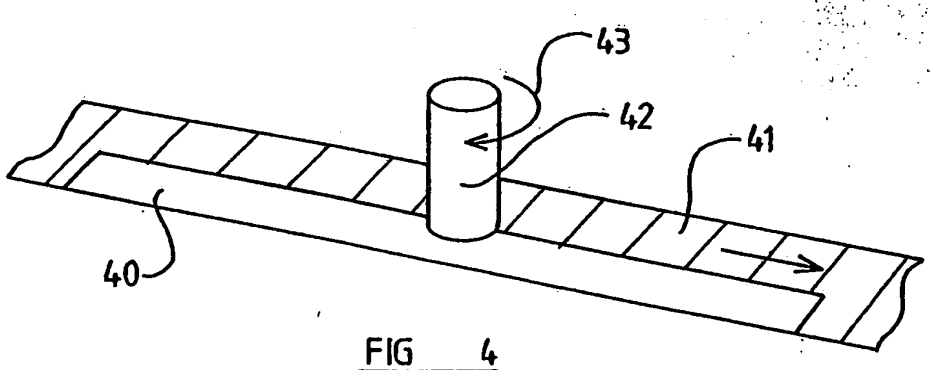

FIG 4

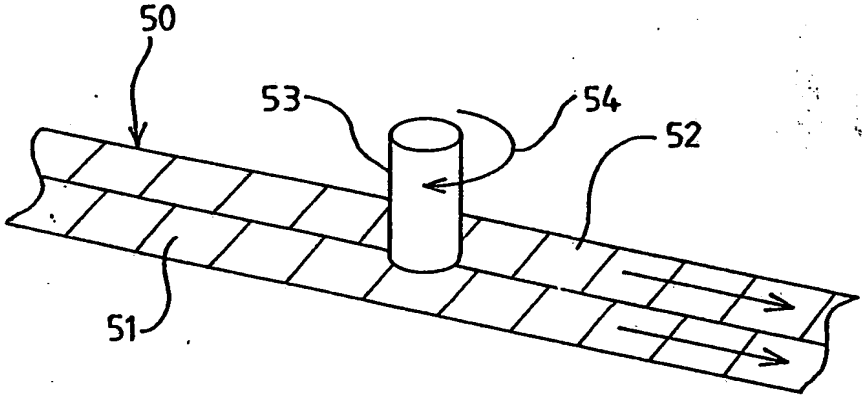

FIG 5

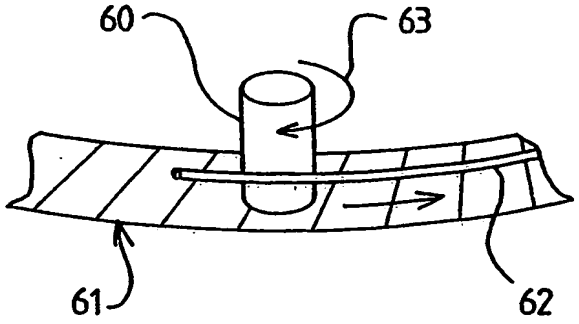

FIG 6

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 01/05234

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F26B15/18 F26B21/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 F26B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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Date of the actual completion of the international search	Date of mailing of the international search report
6 February 2002	13/02/2002

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016	Silvis, H

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

Int onal Application No
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